HX370S Circuit Description

1. Receive Signal Path

Incoming RF from the antenna jack is delivered to the RF Unit and passes through a low-pass filter consisting of coils L1023, L1026, and L1027, capacitors C1227, C1273, C1276, C1270, C1257, and C1256, and antenna switching diode D1036.

Signals within the frequency range of the transceiver enter a Varactor-tuned band-pass filter consisting of coils L1022 and L1021, capacitors C1246, C1244, and C1242, and diodes D1048, then amplified by Q1058 and enter a Varactor-tuned band-pass filter consisting of coils L1018, L1017 and L1016, capacitors C1211, C1208, C1210, C1212, C1209, C1207, C1198, C1197, C1196, C1195, and C1194, and diodes D1032, D1031, and D1029, before first mixing by Q1054.

Buffered output from the VCO is amplified by Q1024 to provide a pure first local signal between 112.3 and 152.3 MHz for injection to the first mixer Q1054.

The 21.7 MHz first mixer product then passes through monolithic crystal filter XF1001/XF1002 to strip away all but the desired signal, which is then amplified by Q1046.

The amplified first IF signal is applied to FM IF subsystem IC Q1039, which contains the second mixer, second local oscillator, limited amplifier, noise amplifier, and RSSI amplifier.

A second local signal is produced from the PLL reference/second local oscillator of X1001 (21.25 MHz). The 21.25 MHz reference signal is delivered to mixer section of Q1039 which produce the 450 kHz second IF mixed with the first IF signal.

The second IF then passes through the ceramic filter CF1001 (on “Narrow” channels) or CF1002 (on “Wide” channels) to strip away unwanted mixer products, and is then applied to the limited amplifier in Q1039, which removes amplitude variations in the 450kHz IF, before detection of the speech by the ceramic discriminator CD1001.

2.Audio Amplifier

The demodulated audio signal from the Q1039 passes through a band-pass filter and High-pass filter to the Voice Scrambler Unit when the optional Scrambler Unit is installed, then applied to the de-emphasis. Then passes through the audio volume and the audio power amplifier Q1010, providing up to 400 mW of audio power to the 4 Ω loudspeaker.

3. Squelch Control

The squelch circuitry consists of a noise amplifier and band-pass filter and noise detector within Q1039.

When no carrier received, noise at the output of the detector stage in Q1039 is amplified and band-pass filtered by the noise amplifier section of Q1039 and the network between pins 7 and 8, and then rectified by detection circuit in Q1039.

The resulting DC squelch control voltage is passed to pin 52 of the microprocessor Q1066. If no carrier is received, this signal causes pin 52 of Q1066 to go high and pin 30 to go high. Pin 11 signals of Q1053 to disable the supply voltage to the audio amplifier Q1010, while pin 7 hold the green (Busy) half of the LED off, when pin 11 is high and pin 7 is high.

Thus, the microprocessor blocks output from the audio amplifier, and silences the receiver, while no signal is being received (and during transmission, as well).

When a carrier appears at the discriminator, noise is removed from the output, causing pin 75 of Q1039 to go low and the microprocessor to activate the ”Busy” LED via Q1053.

The microprocessor then checks for CTCSS or CDCSS code squelch information, if enabled. If not transmitting and CTCSS or CDCSS is not activated, or if the received tone or code matches that programmed, allows audio to pass through the audio amplifier Q1010 to the loudspeaker by enabling the supply voltage to it via Q1014.

4. Transmit Signal Path

The speech input from the microphone MC1001 passes through the audio amplifier

Q1076 to Q1076, which is, adjusted the microphone gain. The speech signal passes through pre-emphasis circuit to Q1076, which contains the IDC, and low-pass filter.

The filtered audio signal is applied to Q1033 which is adjusted the audio level, then is applied to varactor diode D1006, which frequency modulates the VCO Q1012. A portion of the audio signal from Q1033 is applied to X1001.

The processed audio may then be mixed with a CTCSS tone generated by Q1066 for frequency modulation of the PLL carrier (up to ±5 kHz from the unmodulated carrier) at the transmitting frequency.

If a CDCSS code is enabled for transmission, the code is generated by microprocessor Q1066 and delivered to X1001 (21.25 MHz) for CDCSS modulating.

The modulated signal from the VCO Q1012 is buffered by Q1013. The low-level transmit signal is then passes through the TX switching diode D1012 to the buffer amplifier Q1032, driver amplifier Q1036, then amplified transmit signal is applied to the final amplifier Q1045 up to 5.0 watts output power.

The transmit signal then passes through the antenna switch D1034 and is low-pass filtered to suppress harmonic spurious radiation before delivery to the antenna.

4-1 Automatic Transmit Power Control

Current from the final amplifier is sampled by C1237, C1236, C1208, R1273, and R1272, and is rectified by Q1062. The resulting DC is fed back through Q1062 to the drive amplifier Q1036 and final amplifier Q1045, for control of the power output.

The microprocessor selects ”High” or “Low” power levels.

4-2 Spurious Suppression

Generation of spurious products by the transmitter is minimized by the fundamental carrier frequency being equal to final transmitting frequency, modulated directly in the transmit VCO. Additional harmonic suppression is provided by a low-pass filter consisting of coils L1012 and L1013 plus capacitors C1165, C1291, C1167, C1169, and C1190, resulting in more than 60 dB of harmonic suppression prior to delivery to the antenna.

5. PLL Frequency Synthesizer

The PLL circuitry on the Main Unit consists of VCO Q1012, VCO buffer Q1013, PLL subsystem IC Q1017, which contains a reference divider, serial-to-parallel data latch, programmable divider, phase comparator and charge pump, and crystal X1001 which frequency stability is ±2.5 ppm @ -30 to +60 °C.

While receiving, VCO Q1012 oscillates between 115.3 and 152.3 MHz according to the transceiver version and the programmed receiving frequency. The VCO output is buffered by Q1016, then applied to the prescaler section of Q1017. There the VCO signal is divided by 64 or 65, according to a control signal from the data latch section of Q1017, before being sent to the programmable divider section of Q1017.

The data latch section of Q1017 also receives serial dividing data from the microprocessor Q1066, which causes the pre-divided VCO signal to be further divided in the programmable divider section, depending upon the desired receive frequency, so as to produce a 5.0 kHz or 6.25 kHz derivative of the current VCO frequency.

Meanwhile, the reference divider sections of Q1017 divides the 21.25 MHz crystal reference from the reference oscillator Q1066, by 3360 (or 2688) to produce the 5.0 kHz (or 6.25 kHz) loops reference (respectively).

The 5.0 kHz (or 6.25 kHz) signal from the programmable divider (derived from the VCO) and that derived from the reference oscillator are applied to the phase detector section of Q1066, which produces a pulsed output with pulse duration depending on the phase difference between the input signals.

This pulse train is filtered to DC and returned to the Varactor D1006.

Changes in the level of the DC voltage applied to the Varactor, affecting the reference in the tank circuit of the VCO according to the phase difference between the signals derived from the VCO and the crystal reference oscillator.

The VCO is thus phase-locked to the crystal reference oscillator. The output of the VCO Q1012 after buffering by Q1013, is applied to the first mixer as described previously.

For transmission, the VCO Q1012 oscillates between 134.00 and 174.00 MHz according to the model version and programmed transmit frequency. The remainder of the PLL circuitry is shared with the receiver. However, the dividing data from the microprocessor is such that the VCO frequency is at the actual transmit frequency (rather than offset for IFs, as in the receiving case). Also, the VCO is modulated by the speech audio applied to D1005, as described previously.

6. Miscellaneous Circuits

Push-To-Talk Transmit Activation

The PTT switch on the internal microphone is connected to pin 47 of microprocessor Q1066, so that when the PTT switch is closed, pin 47 of Q1066 goes low. This signal disables the receiver by disabling the 5 V supply bus at Q1029 to the front-end, FM IF subsystem IC Q1039.

At the same time, Q1028 and Q1025 activate the transmit 5 V supply line to enable the transmitter.